

Claims

I, (We) claim:

1. A Logic Based Electronic Controller for managing the flow of water through a piping system, the supply being a main water supply line from either a utility or from a well head which communicates flow and pressure along piping to the residential or small business property, a plurality of electrically actuated solenoid valves for flow control into the piping from the supply including a main shut off valve and a solenoid actuated valve for dividing the piping of independent usage at the property into two sections called the supply (and supply being all of the piping from the supply source to the point of entry into the property) and the structure piping (being all piping to include branches that are beyond the point of entry), and a solenoid actuated valve for draining the piping, and a solenoid actuated valve for prevention of vacuum during the drain, a water pressure sensor located both at the beginning of the supply and at the beginning of the structure piping, a flow sensor being at the beginning of the structure piping, and all sensors being for the purpose of sending signal relating to their sensing meaning a pressure sensor delivers signal relative to current piping pressures and a flow sensor delivers signal relative to current flow within a piping system, a thermal sensor communicating with controller to deliver signals relating to current temperature of water in hot water heater inline with said piping system, a electrical relay being able to remove and or supply water heater with supply electrical current. Specifically the solenoid actuated valve employed as the main valve for the RWMS system is a bi-positional valve that requires independent signals to place it in either the Open or Closed states; being best described as:

...a full and complete Water Management System developed into a single programmable electronic controller specifically designed to both aid in Water

Conservation, and provide full control and monitoring of all aspects of a plumbing system, including Water Usage Counting, Flow Control, Leak Detection, Programmable Modes, Water Heater on/off, hot water temperature and irrigation/sprinkler system(s); A device which allows the user to monitor, control, purge and adjust the entirety of a plumbing system; A device which applies the principle... "increased pressure IS= decreased flow"..., therefore "stable pressure IS ALSO= absence of flow", to facilitate a completely accurate method of leak detection in plumbing; A device which provides property damage prevention, reduced opportunity for toxic mold development, resulting in more healthy living environment(s); An Innovative Technologies Approach to Water Conservation and user friendly tool, to develop, monitor and participate in the urgent need to conserve drinking water resources.

With said Controller Comprising:

flow control means controlling the flow of water through any piping beyond valves of control in response to pressure anomalies which trigger a counting of water until a user programmed amount in gallons has been reached; **device means** Logic Based Electronic Controller in communications with all peripheral items which constitute a method of control and usage monitoring for water piping systems; **pressure anomaly/anomalies means** a point in which stable pressure within a piping system reduces in percentage by an amount relevant to a logical decision that water is in some way escaping a piping system; **benchmark means** the stable pressure in a water piping system at the point in which a measurement of said pressure is taken and or any predetermination of stable pressure in time to allow for temperature and barometric pressure effects on stable water pressures over time; **water piping system(s) means** any piping existing beyond a source of supply; **installation means** the performing of physical acts to place the device and the minimum described peripherals herein

and or any additional peripherals also described herein into operation in a residential or business property and with operational limits which are established to match or meet the flow control values best determined at this time to optimize the operational functionality for said property; **plumbing and or piping system** means an interchangeable word or phrase which both have the same intended meaning and describe a system of conduit in which water flows from a source of that water to the intended usage point including peripheral items such as a water heater.

2. A device, as claimed in claim 1 wherein:

a response from a signal communicated from a pressure sensor affixed inline with a piping system representing a pressure anomaly as described herein is received by a Logic Based Electronic Controller which then causes a main valve located at or nearest to a source of water to open until said pressure sensor communicates that pressure in same piping system has returned to the stable pressure level which existed prior to pressure anomaly or to a pressure lower or higher than that which existed prior to pressure anomaly provided that said pressure is stable for a period of time to represent a new benchmark of water pressure within same piping system.

3. A device, as claimed in claim 2 wherein also:

response to a pressure anomaly causes communication between device and a water flow counting sensor affixed inline with a piping system to determine in gallons and with reasonable accuracy the volume of water which flows through said piping during said anomaly and to terminate the flow at or nearest to the source of flow if an amount is reached which equals or exceeds a pre-programmed volume in gallons as determined at time of installation as described herein.

4. A device, as claimed in claim 2 wherein also:

device will return to a state of monitoring when or if a single anomaly event does not cause a total flow in gallons equal to the amount as specified in claim 3.

5. A device, as claimed in claim 1 further including:

multiple operational characteristics or functionalities known as modes in which each mode varies in purpose and directly enable functional and or operational characteristics which facilitate and or support accomplishment of same.

6. A device, as claimed in claim 5 wherein specifically:

a mode of operation being called "On Mode", or by any other name in which the device causes a full state of water flow through a piping system without any restriction as to the amount of flow in gallons which occur during such time as this mode is the current state of operational selection by the owner/user of device.

7. A device, as claimed in claim 5, wherein specifically:

a mode of operation being called "Watch Mode", or by any other name in which the device is triggered by a pressure anomaly and then allows for flows in gallons of water through a piping system as programmed by the owner/user until the volume of said flow reaches a programmed volume in gallons and device responds by terminating all flow and produces both audible and visual notifications to user and which require user intervention to re-set device to continue any additional flow.

8. A device, as claimed in claim 7 wherein also:

a mode of operation being called "Watch Mode", or by any other name in which the device monitors for pressure anomaly and further determines

rate of pressure decrease over time during said anomaly to logically determine whether rate of pressure decrease logically represents a small volume of flow equal to that which is consistent with a small leak or a more continuous and or voluminous flow which would be logically determined to be intentional usage and where the device will produce audible and visual alerts if the pressure decrease over time logically represents a small volume of total flow.

9. A device, as claimed in claim 5, wherein specifically:

a mode of operation being called "Away Mode", or by any other name in which the owner/user causes device to communicate with a main valve located at or nearest to a source of supply to discontinue any flow through a piping system beyond said valve and also may cause a water heater to be operationally disabled and under which operational condition no flow of water may occur in said piping system until such time that the owner/user cause the device to be removed from said mode.

10. A device, as claimed in claim 5, wherein specifically:

a mode of operation being called "Purge Mode", or by any other name in which the owner/user causes device to communicate with a main valve to discontinue any flow or re-pressurizing of a water piping system beyond said valve, and causes communication with a drain valve being caused to open to allow for existing water volumes to be encouraged by gravitational and or siphon forces to be evacuated from a piping system, and where device communicates with a vacuum release valve to open to allow for air to enter a piping system to further facilitate the evacuation of volumes of water from a piping system, and where the said drain and vacuum release valves remain open until the owner/user

causes device to communicate signals to cause said drain and vacuum release valves to close and where a signal may also cause the opening of a solenoid actuated valve at the drain of a hot water heater as to also cause the evacuation of volumes of existing water in said heater which is also closed when owner/user causes said drain and vacuum valves to close.

11. A device, as claimed in claim 10, wherein also:
a signal may also be given to an electrically operated pump for the purpose of assuring total evacuation of any volume of water which may exist in a piping system being disconnected from its supply.

12. A device, as claimed in claim 10, wherein also:
user/owner must cause the device to vacate said mode to cause the device to return to the normal operation mode as described in claim 7 and subsequent claims relating to claim 7 which results in a signal to the main valve to open and allow for the re-connection to main water supply.

13. A device, as claimed in claim 5, wherein specifically:
a mode of operation being called "Locate Mode", or by any other name in which the device causes a main valve located at the main supply line to close and a locate valve located at the point of entry to the structure to close, and where the device then monitors signals from two pressure sensors which are located beyond each of these said valves for a period of time sufficient to determine which sensor demonstrates a decrease in pressure for the purpose of a determination of which section or sections of a piping system is or are leaking at any point within said section.

14. A device, as claimed in claim 13, wherein also:
a display of the result of the separate monitoring of signals from the two

pressure sensors gives the owner/user results from the test which indicate whether a pressure reduction condition is found to have existed on the supply piping or the structure piping or both and this pressure reduction being sufficient to logically determine or establish that a leak is present and where this mode may be manually initiated by the owner/user or automatic in response to a leak determination in any other mode.

15. A device, as claimed in claim 5, wherein specifically:
a mode of operation being called "Water Counter Mode" or by any other name in which the device causes the setting of an internal counter to be zero (0) and which the device communicates with a flow counting sensor which delivers signal relating to water flow in gallons to incrementally increase the counter to reflect an amount which flows and visually display this information to owner/user on a screen which is affixed to the face of the device and/or utilize voice synthesis to simulate a human speech to audibly emit understandable language which reflect this amount in gallons.

16. A device, as claimed in claim 5, wherein specifically:
a mode of operation being called "Sleep Mode" or by any other name in which the owner/user programs times of day in which the device causes the main valve to close and then where signals are communicated from the main pressure sensor which represent the maintenance of static pressure or the decrease in static pressure which the later is known as an anomaly and causes said closure and where a signal may be sent to cause an electrically actuated relay to disconnect the electrical supply to a water heater and where this mode is automatically entered and exited from as programmed by the Owner/User.

17. A device, as claimed in claim 16, wherein also:

a pressure anomaly will cause the opening of the main valve to re-supply volume and pressure to a piping system and where a flow counting sensor delivers signal relative to amount of flow in gallons and where the main valve will be caused to close if an amount of flow in gallons is reached which is programmed by the owner/user and this amount is limited to a maximum programmable setting determined during installation of device and where a visible and or audible alert is provided to the owner/user by the controller device and where the device will return to a state of monitoring should the programmed flow amount not be reached during a single pressure anomaly condition.

18. A device, as claimed in claim 16, wherein also:

Owner/User can store into internal memory a programming for three (3) daily times for the device to automatically enter this mode during the normal working week meaning that time normally considered to be beginning at midnight on each Sunday and ending at four o'clock p.m. on each Friday but being able to be determined by each user by programming specific to their own normal schedule.

19. A device, as claimed in claim 16, wherein also:

Owner/User can store into internal memory a programming for three (3) daily times for the device to automatically enter this mode during the normal weekend meaning that time normally considered to be beginning at four o'clock p.m. on each Friday and ending at midnight on each Sunday but being able to be determined by each user by programming specific to their own normal schedule.

20. A device, as claimed in Claim 5, wherein also:

a user may by programming control the operation of a plurality of valves which are opened and closed again as programmed for areas or zones of control for the purpose of irrigation and where all other device programming may be vacated to allow for such flow as is necessary to meet either timing of flow or specific flow in gallons programming by the Owner/User.

21. A device, as claimed in Claim 1, wherein:

Owner/User may cause the device to visually display information about total amounts of water usage in gallons relating to daily and weekly and monthly and for the period of the previous twelve (12) months for the purpose of supporting home conservation programs or validating customer water billing statements.

22. A device, as claimed in claim 1, wherein:

Owner/User may program an amount known as "Daily Usage Alarm" or by any other name in which a set amount of daily water usage in gallons is determined by the user to be a goal for maximum daily usage and audible and visual alarms are produced by the device if this amount is exceeded.

23. A device, as claimed in claim 1, further including:

that the User interacts with onscreen menus and sub-menu systems currently being called "Set-Up" and "Mode" or by any other name or names in which this is accomplished, and in which various run time settings and entry to various operational modes are accomplished.

24. A device, as claimed in claim 23, wherein also:

User may program a temperature in which their water heater operates within a range of normal temperatures of such operation.

25. A device, as claimed in claim 1, wherein:

programming internal to device provides contact information about a specific plumbing service or company including service or company name and telephone number as an On Screen Display and in response to any leak determination logically made by device.

26. A device, as claimed in claim 1, wherein:

signals received from a water softening or filtering device which represent the need for user intervention for a maintenance action for said device cause audible and visual alarms at the controller

27. A device, as claimed in claim 1, wherein:

device specific operational characteristics directly support Water Conservation and specifically by providing user with real time and easily acquired information necessary to develop and implement successful home water conservation plans and or programs and by allowing user to establish a daily water usage expectation in gallons that if exceeded will notify user both audibly and visually and by prompting of user to have leaky plumbing repaired.

End Claims